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Factors that affect the use and acceptance of systems development methodologies by system developers

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Abstract

In this study fourteen factors affecting the use and acceptance of systems development methodologies by individual systems developers were investigated. The results show that relative advantage, compatibility and trialability of a systems development methodology, an individual's experience in systems development and his/her experience in systems development methodologies, management support and peer developer support, and uncertainty about the continued existence of the IS department significantly influence the deployment of systems development methodologies.

Keywords

Systems development, systems development methodologies, use, acceptance, developers.

INTRODUCTION

Systems development methodologies (SDM) have formed one of the most intensive research topics in Information Systems (IS) and Software Engineering. In 1994 Jayaratna (1994) estimated the number of methodologies to be of order 1000, and since then many more systems development methodologies have been developed. It is generally assumed that systems development methodologies are used in practice (Saeki, 1998), and there exists a widespread belief that adherence to systems development methodologies (SDM) is beneficial to an organization (Fitzgerald, 1996; Hardy et al., 1995). This belief is manifested in the pressure that practitioners face today to use SDM (Fitzgerald, 1996). Despite the high investment in the development of SDM and the pressure to use it, their practical usefulness is still a controversial issue (Fitzgerald, 1996; Introna and Whitley, 1997; Nandhakumar and Avison, 1999). Many organisations claim that they do not use any methodologies (Huisman and Iivari, 2003; Hardy et al., 1995; Chatzoglou and Macaulay, 1996; Fitzgerald, 1998). Other organizations report that they are adapting SDM (Fitzgerald et al., 2003; Huisman and Iivari, 2003; Hardy et al., 1995; Russo et al., 1996), while others are using it with positive results (Chatzoglou and Macauly, 1996; Rahim et al., 1998). Apart from this, we do not know why SDM are used and what factors influence its use and effectiveness.

A decision by IS management to adopt SDM in an IS department does not guarantee that all developers will use the methodology, or that they will use it to its full potential. The purpose of this paper is to determine which factors influence the individual use and acceptance of SDM. Researchers emphasise that a distinction must be made between the adoption and acquisition of technology at the organisational level and its adoption and implementation at the individual level (Fichman, 1992; McChesney and Glass, 1993; Senn and Wynekoop, 1995; Dietrich *et al.*, 1997; Lai and Guynes, 1997). In terms of Rogers (1995), systems development methodologies are contingent innovations with organisations as primary adopting units and individuals as secondary adopting units. This study will report the use and acceptance of systems development methodologies at the individual level. More specifically, it will study the use and acceptance of systems development methodologies among secondary adopters (individual system developers). The deployment of systems development methodologies among primary adopters (IS departments) is reported in Huisman and Iivari (2002).

CONCEPTUAL RESEARCH MODEL AND RESEARCH HYPOTHESES

Theoretical Background

Most of the previous research into SDM did not have any theoretical orientation but the idea had been just to report the state of use of SDM and techniques in purely descriptive terms, e.g. Hardy et al. (1995) and Chatzoglou and Macaulay (1996). In general terms the present work is influenced by the diffusion of innovations (DOI) theory (Rogers, 1995), which is becoming an increasingly popular reference theory for empirical studies of information technologies (Beynon-Davies and Williams, 2003; Fichman, 1992; Prescott and Conger, 1995).

More specifically, this work is based on the IS implementation model suggested by Kwon and Zmud (1987). They combined IS implementation research and the DOI theory. This resulted in an enlarged model that identifies five categories of factors affecting IS implementation: individual factors, structural (organisational) factors, technological factors (innovation characteristics), task-related factors, and environmental factors. This categorisation provides the overall conceptual framework for this work (Figure 1). However, the selection of individual factors does not follow the model of Kwon and Zmud (1987) precisely for two reasons. Firstly, their list of 23 factors is quite comprehensive to be tested in one study. Secondly, the aim was to identify factors that are more specific to SDM than many of the factors they identified.

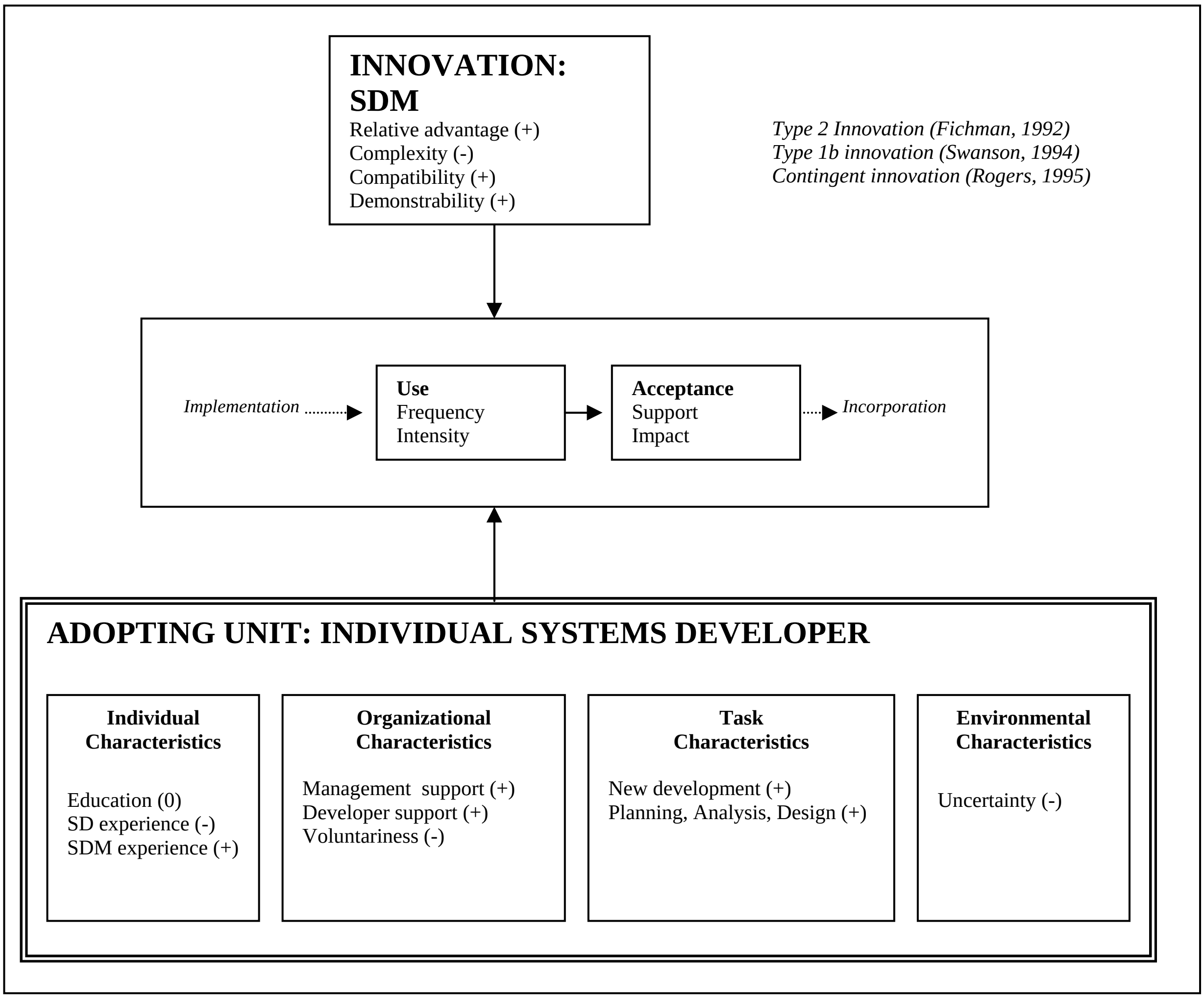

Fig. 1 Conceptual research model for the individual use and acceptance of SDM

According to the tri-core model presented by Swanson (1994), SDM are IS technological process innovations of Type 1b, which focus on the technical core of the IS department, and change the nature of IS work. The social system in this study is an organisation. In terms of Rogers (1995), SDM are contingent innovations with organisations as primary adopting units and individuals as secondary adopting units. This study will focus on the individual systems developer as the adopting unit.

The DOI theory has also been criticised. Fichman (1992) points out that it has mainly addressed individual adoption of relatively simple innovations. Despite of the author's recognition that SDMs are contingent innovations (Rogers, 1995), the focus in this paper lies on individual adoption of SDM. It is also obvious that SDM are fairly complex innovations. They are technologies of Type 2 (Fichman, 1992), which are characterised by a high knowledge burden or high user interdependencies. This means that this study tests the validity of DOI theory partly outside its major focus area. Therefore the detailed hypotheses concerning the deployment of SDM, derived from the classical DOI theory, are quite tentative.

As pointed above there is not much theoretically oriented empirical research into the adoption of SDM, on which to draw in the discussion of detailed hypotheses. To compensate this the author mainly uses existing empirical research on the adoption of CASE technology. There are two reasons for this. Firstly, CASE tools represent relatively complex technologies which are contingent innovations just as SDM. Secondly, the methodology companionship of CASE tools (Vessey et al., 1992) implies that their adoption includes a significant aspect of SDM.

The Innovation: SDM

Trying to define systems development methodologies is no easy task. There is no universally accepted, rigorous and concise definition of systems development methodologies (Avison and Fitzgerald, 1995; Wynekoop and Russo, 1997; Iivari et al., 1999). Avison and Fitzgerald (1995) argue that the term methodology is a wider concept than the term method, as it has certain characteristics that are not implied by method, i.e. the inclusion of a philosophical view. The author uses the term "methodology" to cover the totality of systems development approaches (e.g. structured approach, object-oriented approach), process models (e.g. linear life-cycle, spiral models), specific methods (e.g. IE, OMT, UML) and specific techniques.

Individuals' responses to an innovation are primarily influenced by attributes of the innovation and the implementation process (Leonard-Barton, 1987). The characteristics of SDM that will be studied was suggested by Rogers (1995), namely perceived relative advantage, compatibility, complexity, trialability and observability.

Relative advantage

Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes (Rogers, 1995). After a decade's intensive research on TAM (Davis et al., 1989) in particular, there is significant empirical evidence that relative advantage or perceived usefulness (Moore and Benbasat, 1991) is positively related to innovation use, even though Iivari (1996) discovered it to have a significant relationship with CASE usage only at the organizational level but not at the individual level. This overwhelming evidence leads to the following hypothesis:

H1: There is a positive relationship between relative advantage and the individual use and acceptance of SDM.

Complexity

Complexity is the degree to which an innovation is perceived as difficult to understand and use (Rogers, 1995). It is generally believed that the more complex an individual perceives an innovation to be before using it, the less likely it is that the innovation will be adopted and implemented. Although perceived complexity has generally been assumed to be negatively related to the adoption of innovations (Davis *et al.*, 1989; Moore and Benbasat, 1991; Rogers, 1995), the empirical results regarding the relationship between perceived ease of use (or perceived complexity) and use has been inconclusive (Gefen and Straub, 2000). This is also the case in the adoption of CASE tools (McChesney and Glass, 1993; Iivari, 1996). Despite the inconclusive empirical evidence, the following is postulated in accordance with the DOI theory (Rogers, 1995) and TAM (Davis *et al.*, 1989):

H2: There is a negative relationship between complexity and the individual use and acceptance of SDM.

Compatibility

Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters, and it is positively related to innovation use (Rogers, 1995). Compatibility is sometimes described as the "fit" between an innovation and a particular context, which implies that an innovation must match its context in order to be effective. McChesney and Glass (1993) remark that a detailed assessment should be made of the "fit" between CASE methodology and the systems development tasks it is designed to support, when studying the acceptance of CASE methodology. Iivari (1996) also found some evidence for the significance of compatibility for CASE usage. Following the DOI theory, the next hypothesis is postulated as follows:

H3: There is a positive relationship between compatibility and the individual use and acceptance of SDM.

Demonstrability

Rogers (1995) uses the term "observability" and defines it as the degree to which the results of an innovation are visible to others. He argues that the easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Moore and Benbasat (1991) found that "observability" as originally defined by Rogers consist of two constructs, namely result demonstrability and visibility. Software-dominant innovations are less visible than hardware-dominant innovations (Moore and Benbasat, 1991; Rogers, 1995). Therefore the construct for result demonstrability is used and the following hypothesis is postulated as follows:

H4: There is a positive relationship between demonstrability and the individual use and acceptance of SDM.

Trialability

Rogers (1995) defines trialability as the degree to which an innovation may be experimented with on a limited basis. He argues that innovations, which are trialable, will be adopted more quickly, because it represents less uncertainty to the individual. The formulation of the fifth hypothesis is as follows:

H5: There is a positive relationship between trialability and the individual use and acceptance of SDM.

Innovation Diffusion Process

The main focus is on the use and acceptance of systems development methodologies, which is related to the implementation and confirmation stages of the innovation-decision process as described by Rogers (1995). Since use and acceptance are part of the post-implementation stage, the description of McChesney and Glass (1993) is used in the conceptual research model. After implementation, use and acceptance will follow, which in turn is followed by incorporation. (See Fig.1)

Use will be studied along two dimensions, namely frequency of use and intensity of use (McChesney and Glass, 1993). The acceptance of systems development methodologies will be studied from two perspectives, namely their impact on systems development and the perceived support it provides (McChesney and Glass, 1993). When studying the impact of systems development methodologies, this study will focus on their impact on both the developed system and the development process (Heineman *et al.*, 1994; Wynekoop and Russo, 1997). The support that systems development methodologies provide will be studied along three dimensions, namely the perceived support as production technology, control technology, and cognitive/co-operative technology (Henderson and Cooprider, 1990).

Individual Characteristics

Education

Empirical results regarding the influence of education on the innovation process have been inconclusive. Kwon and Zmud (1987) state that negative associations have been found between education and innovation usage, mixed results have been reported for performance, and negative associations have been found between education and satisfaction with the innovation. This leads to the next hypothesis in its null form:

H6: There is no relationship between education and the individual use and acceptance of SDM.

Experience in systems development

Research suggests that the experience profile of an individual is an important factor in the acceptance and use of SDM. The findings suggest that inexperienced developers are more likely to use SDM and CASE tools (Lee and Kim, 1992; Orlikowski, 1993), while experienced developers may resist using them (Tesch et al., 1995). This leads to the following hypothesis:

H7: There is a negative relationship between an individual's experience in systems development and the individual use and acceptance of SDM.

Experience in SDM

Contrary to Hypotheses H7 Leonard-Barton (1987) argues that experienced developers are more likely to use SDM as they would be more aware of the benefits. Assuming that SDM have benefits, one can assume experienced developers who have experience of using a particular SDM to be more likely to use SDM. Therefore, the following hypothesis is postulated as follows:

H8: There is a positive relationship between an individual's experience with SDM and the individual use and acceptance of SDM.

Task Characteristics

SDM are primarily used in the development of new systems, and are often not as helpful in the enhancement of operational systems (Peacham, 1985). Furthermore, SDM are most effective for analysing the functionality of a newly developed system (Isoda et al., 1995). This leads to the following hypotheses:

H9: There is a positive relationship between the time an individual spends on the development of new systems and the individual use and acceptance of SDM.

H10: There is a positive relationship between the time an individual spends on the planning, analysis and design of a new system and the individual use and acceptance of SDM.

Organisational Characteristics

Individual systems developers do not work and deploy SDM in vacuum but under various social influences. The Theory of Reasoned Action (Fishbein and Ajzen, 1975) posits that an individual's behavior is influenced by his/her perception of the social pressure (subjective norm) to perform or not to perform the behavior. Subjective norm is defined as a multiplicative function of his/her normative beliefs (i.e. perceived expectations of specific referent individual and groups) and his/her motivation to comply with these expectations. The relevant referent groups may be top managers, supervisors, peers and friends. Karahanna et al. (1999) tested the influence of a number of referent groups on the subjective norms of potential *adopters* and *users* of Microsoft Windows 3.1 software. They found that top management, supervisors and peers significantly underlie subjective norms for both groups, and additionally local computer specialists for users. On the other hand, they discovered subjective norms to have a significant influence on behavioral intention to adopt but not on behavioral intention to continue using. In line with Karahanna et al. (1999) this study will focus on manager influence, including both top management and IT managers, and peer developer influence.

Management Support

Management support is consistently reported to facilitate IS implementation (Ginzberg, 1981). When one considers SDM, Isoda et al. (1995), Roberts and Hughes (1996) and Roberts et al. (1998) list a lack of management commitment as one of the biggest obstacles to implementing SDM. Iivari (1996) also reports management support to have significant effects on CASE usage both at the individual and organizational level. This leads to the next hypothesis:

H11: There is a positive relationship between management support and the individual use and acceptance of SDM.

Developer support

To the author's knowledge there is not much previous research on peer influence on the use and acceptance of innovations in general, IT innovations more specifically, and SDM innovations in particular. Despite that the following hypothesis is proposed:

H12: There is a positive relationship between developer support for the systems development methodology and the individual use and acceptance of SDM.

Voluntariness

Voluntariness is the degree to which an innovation is perceived as being voluntary or of free will (Moore and Benbasat, 1991). When we consider contingent innovations, the secondary adopters rarely have complete autonomy regarding their adoption and use in the workplace. Furthermore, SDM are complex innovations, and unless management declares their use mandatory, systems developers will have difficulty to fit them into their tight schedule. Iivari (1996) found strong support for the negative influence of voluntariness on CASE usage. This leads to the next hypothesis:

H13: There is a negative relationship between voluntariness and the individual use and acceptance of SDM.

Environmental Characteristics

Uncertainty

The deployment of SDM can be justified as an investment in the maintainability of systems, supported by proper documentation and proper modular structuring. Therefore, if the future of the IS department is uncertain or under threat, it may decrease the motivation to deploy the SDM. Unfortunately, to the author's knowledge there is no previous work on this relationship. Rai and Howard (1994) concluded that users may be unwilling to support new initiatives in an IS department in which they have limited confidence. On the other hand, uncertainty is believed to stimulate innovation through an organisation's effort to survive and grow (Kwon and Zmud, 1987). On the whole, the next hypothesis is formulated as follows:

H14: There is a negative relationship between the uncertainty about the continued existence of an IS department and the individual use and acceptance of SDM.

RESEARCH DESIGN

The Survey

This study is part of a larger survey on the deployment of SDM in South Africa, which was conducted between July and October 1999. The 1999 IT Users Handbook (the most comprehensive reference guide to the IT industry in South Africa) was used and the 443 listed organizations were contacted via telephone to determine if they were willing to participate in the study. 213 organizations agreed to take part. A package of questionnaires was sent to a contact person in each organization who distributed it. This package consisted of one questionnaire to be answered by the IT manager, and a number of questionnaires to be answered by individual systems developers in the organization. The response rate of the survey was as follows: 83 organizations (39%), 234 developers (26%) and 73 managers (34%) responded. The responses came from organisations representing a variety of business areas, manufacturing (33%) and finance/banking/insurance (15%) as the major ones. At the individual level the respondents reported considerable experience in SD, 22% between 3 and 5 years, 23% between 5-19 years and 38% more than 10 years.

Measurement

Measurement of Dependent Variables

In Table 2 the measurement of the different aspects used to study the use and acceptance of SDM is depicted. Frequency of use was measured using a question of how frequently the respondent needed or applied SDM knowledge (never; once a month or less: a few times in a month; several times in a week; every working day). Intensity of use was measured as the maximum of the individual usage of 29 listed methods, possible other commercial methods and possible in-house developed methods.

Table 2: Measurement of use and acceptance

Deployment aspects	Perspectives	Measurement	Reliability
Use	Frequency of use	2 items	0.84
	Intensity of use		
Support	Production technology	11 items (see Iivari and Huisman, 2001)	0.94
	Control technology	9 items (see Iivari and Huisman, 2001)	0.94
	Cognitive/co-operation technology	11 items (see Iivari and Huisman, 2001)	0.91
Impact	Quality of developed systems	8 items (see Iivari and Huisman, 2001)	0.95
	Quality and productivity of development process	10 items (see Iivari and Huisman, 2001)	0.94

One might also ask what independent variables explain use and acceptance of SDM in total. To answer this question, factor analysis on the seven aspects of deployment was performed, and this resulted in one factor with a reliability of 0.82. To measure total individual use and acceptance, the factor scores resulting from the factor analysis was used.

Measurement of Independent Variables

The measurement of the independent variables is summarised in Table 3. As Table 3 shows most measures were adopted from earlier research, and they have high reliability. The two items of uncertainty concerned the threat that the IS department is disbanded and the uncertainty of the future of the IS department in the organization.

Table 3: Measurement of independent variables

Type	Characteristic	Measurement	Reliability
Innovation Characteristics	Relative advantage	5 items (adapted from Moore and Benbasat (1991))	0.94
	Complexity	3 items (adapted from Moore and Benbasat (1991))	0.88
	Compatibility	3 items (adapted from Moore and Benbasat (1991))	0.91
	Demonstrability	3 items (adapted from Moore and Benbasat (1991))	0.85
	Trialability	2 items (adapted from Moore and Benbasat (1991))	0.70
Individual Characteristics	Education	Highest qualification obtained	-
	Experience in systems development	Number of years	-
	Experience in the use of SDM	Number of years	-
Task Characteristics	Time spent on the development of new applications	%	-
	Time spent on planning, analysis, and design activities	%	-
Organisational Characteristics	Management support	2 items (adapted from Iivari (1996))	0.86
	Developer support	1 item	-
	Voluntariness	2 items (adapted from Moore and Benbasat (1991))	0.82
Environmental Characteristic	Uncertainty	2 items	0.90

Data Analysis

Data analysis was performed on the developer responses using Statistica software. In the first analysis the seven different aspects of use and acceptance were treated separately as the dependent variables. To identify the most important independent variables that explain the dependent variables, best subset multiple regression analysis was performed. In a second analysis, total use and acceptance was treated as the dependent variable, and best subset multiple regression was performed.

Multiple regression analysis assumes interval or ratio scale measurement, linearity, homoscedasticity, i.e. the constancy of the residual terms across the values of the predictor variables, independence of residuals, normality of residuals, and no multicollinearity (Hair, 1992). These assumptions were tested and no violations were detected.

RESULTS

The results of the best subset multiple regression analysis with the seven different aspects of use and acceptance of SDM as the dependent variables are presented in Table 4.

The last column of Table 4 contains the results of the regression analysis where total use and acceptance was the dependent variable. To confirm the results of the regression analysis with total use and acceptance as the dependent variable, canonical analysis was performed. Canonical analysis is used to determine the relationship between two sets of variables. The seven different aspects of use and acceptance formed the first set, and the fourteen independent variables the second set. The resulting Canonical R was 0.90 at the level of $p \leq 0,001$, and the eigenvalue of the first root was 0.81. The factor structures of the two sets confirmed the results of the factor analysis and the regression analysis.

Table 4: Results of the regression analysis

N=173	Frequency of use	Intensity of use	Support: Production technology	Support: Control technology	Support: Cognitive/ co-operation technology	Impact: System	Impact: Process	Total use and acceptance
Relative advantage	0.34**	0.24’	0.25**	0.45***	0.49***	0.17’	0.39***	0.39***
Complexity			0.09					
Compatibility	-0.15	-0.20	0.20*	0.11		0.44***	0.27**	0.17*
Demonstrability		0.15’				0.10’		0.06
Trialability	0.08	0.11	0.08	0.10’	0.12*		0.08	0.10*
Education			0.06				0.06	
SD experience	-0.17*		-0.12*			-0.12*	-0.09’	-0.11*
SDM experience	0.45***	0.21**	0.10		0.07			0.14**
Time: Develop new applications					0.10’		0.08	0.05
Time: Planning, Analysis, Design	0.23***							
Manager support	-0.16*		0.29***	0.25***	0.10	0.10	0.18**	0.16**
Developer support	0.10		0.11’		0.20**	0.08		0.11’
Uncertainty	-0.08		-0.13**	-0.15**		-0.07	-0.10’	-0.09*
Voluntariness	-0.13’		0.07				0.07	
R	0.71	0.40	0.82	0.75	0.77	0.76	0.78	0.86
R^2	0.51	0.16	0.68	0.57	0.60	0.58	0.60	0.74
Adjusted R^2	0.48	0.13	0.66	0.56	0.58	0.56	0.58	0.73
F	17.65***	6.60***	32.11***	45.28***	41.88***	33.39***	27.94***	46.43***

‘ $p \leq 0,10$ * $p \leq 0,05$ ** $p \leq 0,01$ *** $p \leq 0,001$

DISCUSSION AND FINAL COMMENTS

In this paper the purpose was to study factors that influence the individual use and acceptance of SDM. Fourteen possible factors were identified and fourteen hypotheses were postulated about their relationship with the individual use and acceptance of SDM. These are summarised in Table 5.

The results show that the classical DOI theory (Rogers, 1995) is relevant and useful in the case of individual use and acceptance of complex innovations such as SDM (see Fichman (1992)). The results indicate that especially relative advantage, compatibility less systematically and trialability more weakly have significant positive relationships with the individual use and acceptance of SDM. Relative advantage is positively related to all seven different aspects of individual use and acceptance of SDM. This suggests that individual systems developers’ decisions to use and accept SDM mainly take place on rational grounds. If a systems developer sees SDM to provide relative advantage he or she is prepared to use it and to derive the benefits of using it. While compatibilty is strongly related to the perceived impact of SDM on the developed system and the development process, it is perplexing that it has negative, although not significant, beta coefficients with the methodology use. One explanation may be that when a SDM is highly compatible with a developer’s way of working, its use may be quite routine and even tacit. It may be that the items measuring methodology use were not fully able to capture this routine or tacit nature of SDM use. On the other hand, when a methodology is perceived to be compatible with one’s way of working, its benefits are perceived to be higher in terms of its impact on the quality of the system to be developed and the development process. Although trialability is not significantly related to the many aspects of deployment, it is related to use and acceptance of SDM in total. On the other hand, contrary to the predictions of the DOI theory, complexity and demonstrability were not significantly related to the individual use and acceptance of SDM. In order to explain this findings, ANOVA/MANOVA analysis was performed to test whether there is a difference in the use and acceptance of SDM among developers that received formal or informal training on the one hand or no training on the other hand. Developers that received formal or informal training reported statistically significant higher values for al seven aspects of use and acceptance than developers who did not receive any training. Therefore one could argue that training decrease the complexity of SDM.

Table 5: Summary of results

H1	There is a positive relationship between relative advantage and the individual use and acceptance of SDM	Strongly supported
H2	There is a negative relationship between complexity and the individual use and acceptance of SDM	Not supported
H3	There is a positive relationship between compatibility and the individual use and acceptance of SDM	Partially supported
H4	There is a positive relationship between demonstrability and the individual use and acceptance of SDM	Not supported
H5	There is a positive relationship between trialability and the individual use and acceptance of SDM	Weakly supported
H6	There is no relationship between education and the individual use and acceptance of SDM	Supported
H7	There is a negative relationship between an individual's experience in systems development and the individual use and acceptance of SDM	Partially supported
H8	There is a positive relationship between an individual's experience with SDM and the individual use and acceptance of SDM	Partially supported
H9	There is a positive relationship between the time an individual spends on the development of new systems and the individual use and acceptance of SDM	Not supported
H10	There is a positive relationship between the time an individual spends on the planning, analysis and design of a new system and the individual use and acceptance of SDM	Not supported
H11	There is a positive relationship between management support and the individual use and acceptance of SDM	Supported
H12	There is a positive relationship between developer support for the systems development methodology and the individual use and acceptance of SDM	Weakly supported
H13	There is a negative relationship between voluntariness and the individual use and acceptance of SDM	Not supported
H14	There is a negative relationship between the uncertainty about the continued existence of an IS department and the individual use and acceptance of SDM	Weakly supported

Systems development experience was negatively related to the individual use and acceptance of SDM. This is in accordance with earlier findings that methodologies are used more by beginners than experienced developers (Lee and Kim, 1992; Orlikowski, 1993). However, to complicate the situation, experience with SDM was positively related to the individual use and acceptance of SDM. More experienced systems developers had more experience with SDM as indicated by the correlation coefficient ($r = 0{,}47$, $p \leq 0{,}001$). So, as individuals they comprise two characteristics that are opposite to each other with regard to the deployment of SDM: experience with SDM being positively associated with the deployment and SD experience being negatively associated with the deployment. When one considers the different aspects of use and acceptance of SDM the picture becomes a bit clearer. SD experience is mainly negatively related to the perceived impact of SDM on the developed system and the development process, and SDM experience is strongly positively related to the use of SDM.

The results also lend support for the significance of social influences on the individual use and acceptance of SDM. A significant positive relationship was found between management support and the individual use and acceptance of SDM. Furthermore, an almost significant positive relationship was found between developer support and the individual use and acceptance of SDM. These results are in line with previous research on the adoption of complex innovations (Fichman, 1992) and confirm earlier findings on the significance of management support in the case of software process improvement initiatives (Herbsleb et al., 1997).

The above results have clear practical implications. Assuming that use and acceptance of SDM are desirable, one should attempt to ensure that the individual systems developers perceive the methodologies to have relative advantage and compatibility with their work. The potential benefits of a methodology and reasons for its introduction should be made clear and communicated to the systems developers. However, the author does not believe that these perceptions can be changed using unilateral communication, but the benefits and compatibility should be discussed openly with systems developers. The significance of compatibility suggests that one should also be prepared to adapt and customise a methodology to fit the organization and the project as far as it does not threat the central reasons of introducing a methodology.

The trialability of SDM was also found significant. This would suggest that one should pay attention to the way of introducing a methodology. It can take place in pilot projects or applying only part of a methodology (e.g. starting from requirements engineering). As always in pilot projects one should pay attention to their selection as well to the selection of the participants. The participants should be motivated. Although it is not tested in this study, it would also be useful if they could serve as opinion leaders later, if the methodology is to be diffused more widely in the organisation. Referring to the significance of experience, it is important to ensure that the pilot project is as pleasant an experience as possible. The pilot project may be introduced as an opportunity to learn a new methodology that enhances and possibly updates the expertise of the participants (as could be the case when introducing some OO methodology).

It is also significant that management communicates its support for the SDM introduction and use. The results also suggest that uncertainty concerning the future of the IS department is detrimental to methodology use and acceptance. Therefore, if the IS department is not under real threat, one should attempt to decrease such uncertainty.

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